Upstart

One Year Later: AI Underwriting & Portfolio Performance Through COVID

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I have spoken with many lenders about the opportunity to use machine learning techniques to improve underwriting outcomes. Almost everyone I speak to acknowledges that there is a substantial opportunity for improved risk modeling to approve more applicants without increasing the risk in their portfolio.

Indeed, an analysis we performed with Transunion showed that while 80% of Americans have never defaulted on a credit obligation, fewer than half have the prime credit profile needed to qualify for a loan with a traditional bank.[1]

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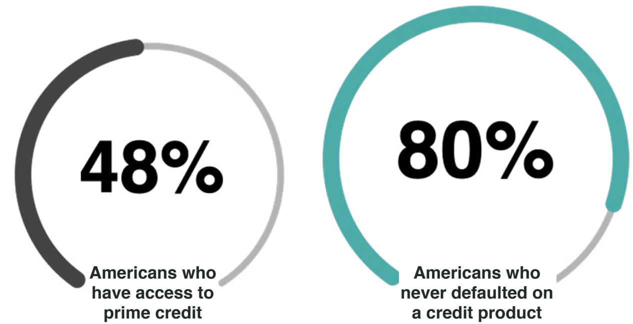
While Upstart's underwriting history has demonstrated the ability to identify a substantial number of those "hidden prime" borrowers, many lenders shared a similar hesitation — what will happen to the model performance during a period of macroeconomic stress?

We've run lots of stress testing and loss forecasting scenarios over the years. But ultimately, the only way to fully answer the question of whether the model will hold up during an economic downturn is to observe our loan performance through such a downturn. Over the last year, the economic stress caused by the COVID-19 pandemic has given us an opportunity to observe the performance of Upstart's underwriting model during such a downturn. While we are by no means past the long-term economic consequences of the

COVID-19 pandemic, we do have enough loan performance data from the past year to get a clear picture of how the credit model has held up.

Before I go through the results, I do want to highlight two large caveats. First, while we have seen substantial recovery in our economy, we are keenly aware that we are still in a very stressed environment. This is not a declaration of victory, so much as an assessment of performance to date. Second, every macroeconomic stress is unique in its impacts. We recognize that while this performance may give a directional indication of likely performance in future shocks, we don't want to over-generalize these results.



Payment Impairments

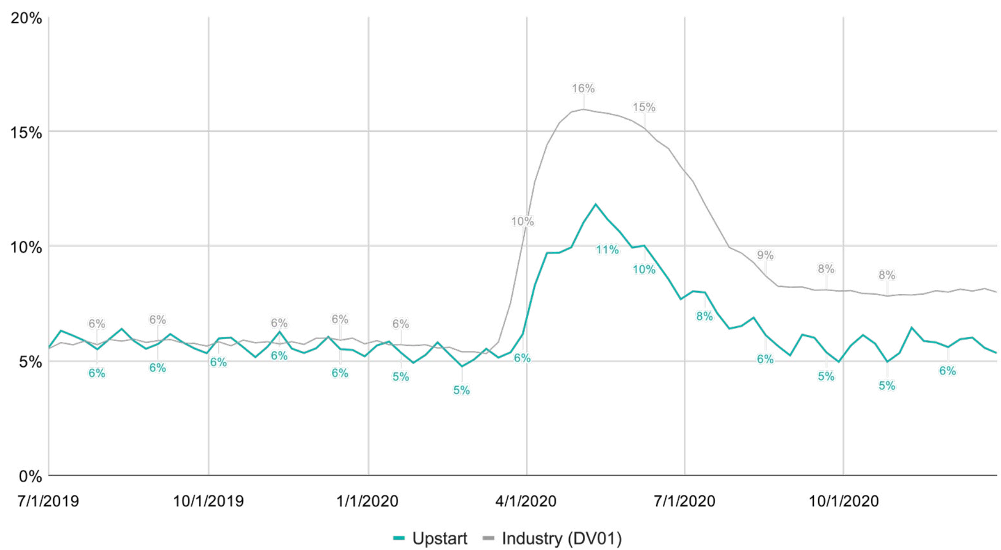
While we use a large number of metrics to evaluate performance internally and with our lending partners, I want to focus on one elucidative data point for this analysis — payment impairment.[2] This is a metric that calculates the total percentage of a portfolio not making on-time payments, either due to participation in a hardship program (which almost all lenders, including Upstart, have offered during the pandemic), or due to being delinquent. We will also compare Upstart's platform-wide performance with the broader online personal lending industry using reports from DV01.

The pre-crisis data shows that the total level of payment impairment of personal loans underwritten by Upstart was similar to the industry average, between 6% and 7%, despite the fact that the average credit score for the borrowers in the Upstart platform portfolio was nearly 25 points lower. This is one demonstration of the power of Upstart's model pre-crisis — the presence of similar impairment rates despite serving a wider borrower population which appeared riskier by traditional metrics.

During the pandemic in 2020, the industry average rate of impairment increased a full 10 percentage points to nearly 16% at its peak in May 2020. The Upstart platform portfolio saw an increase of only 6% at peak — leading to a peak impairment rate of just over 11% in May 2020. At the peak of the crisis in May 2020, despite having a portfolio that appears riskier when judged by traditional metrics like average credit score, impairment across the Upstart platform increased 40% less than the industry as a whole. It is important to note that this increase in impairment was driven almost entirely by the borrower hardship program we offered, with delinquency rates of loans generated through the Upstart platform outside of the borrower hardship program seeing a negligible increase during the crisis.[3]

"At the peak of the crisis ... impairment across the Upstart platform increased **40% less than the industry as a whole**."

Percentage of Portfolio in Payment Impairment[4]

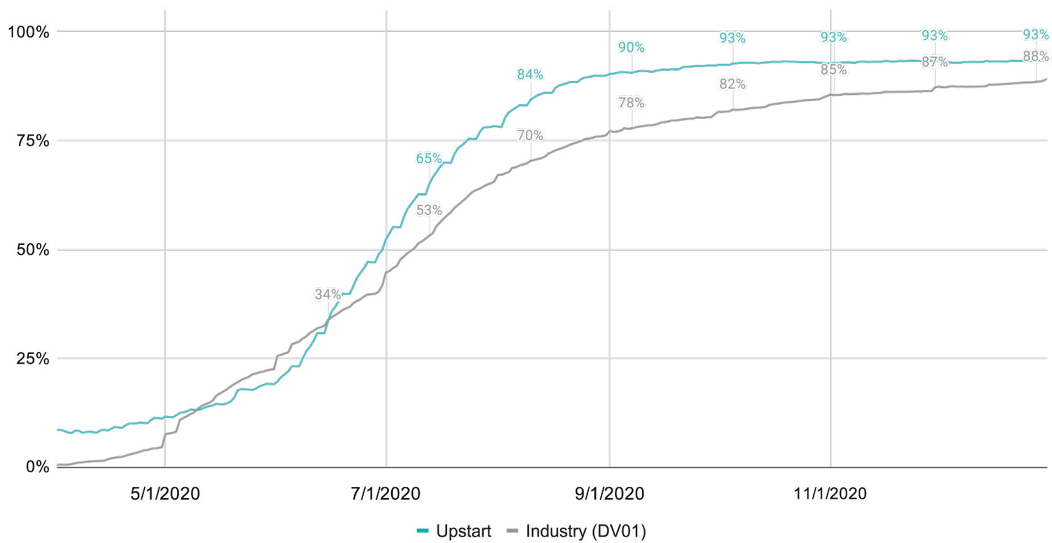


Hardship and Recoveries

After seeing the increase in payment impairments driven primarily by hardships, the next logical question is what portion of borrowers who entered a hardship program recovered to making on-time payments.

As of December 31, 2020, the Upstart platform has seen a rate of recovery of over 93% compared to an industry average of 88%. This means that not only did fewer borrowers on the Upstart platform require a hardship program, but more of those borrowers began promptly making on-time payments after exiting the hardship program. Indeed, between the low rate of impairment and high rate of recovery, lenders leveraging Upstart's platform have not seen a material impact on their return due to the macroeconomic stress brought on by the COVID-19 pandemic.

Percentage of COVID Hardship Loans that Resumed Payments[5]



The Power of the Upstart Model

The data above is a great indication that when compared to a traditional approach to underwriting, not only were Upstart's models better at identifying and pricing credit risk prior to the pandemic, but that performance held through the crisis. However, the numbers above represent a variety of lenders leveraging the Upstart platform with a wide range of risk appetites. To separate risk among applicants on our platform, Upstart uses our models to estimate loss rates at the time of origination and assigns applicants a corresponding Risk Tier, with Tier 1 being the least risky. Many of our more conservative bank and credit union partners begin by offering lower risk loans in Upstart Risk Tiers 1-4. How valuable was Upstart's risk modeling for those lenders?

To answer this question, we looked at the peak of hardship requests in May 2020 and segmented payment impairment rates by Upstart Risk Tier and by credit score band. This allows us to understand both the capacity of Upstart Risk Tier and credit score bands to separate risk on their own, as well as the interaction effects between the two dimensions. Note that for Upstart Risk Tier, a lower tier number indicates lower risk as predicted at the time of origination. Comparing the averages across Upstart Risk Tier and across credit score bands (bottom row and far right column in the table on page 8) shows that while payment impairment varied only moderately across credit score bands, it was closely correlated with Upstart Risk Tier. The spread in peak payment impairment rate between the lowest and highest Upstart Risk Tiers was ~ 6%, while the difference for credit score bands was ~1%.

Put another way, we found the Upstart Risk Tier was 6x more effective than credit score bands at separating the risk of payment impairment across the credit spectrum.

"Upstart Risk Tier was **6 times more effective** than credit score bands **at separating the risk of payment impairment**."

This difference becomes even more stark when you look at the interaction effects between Upstart Risk Tiers and credit score bands within the segments where our bank partners typically begin originating on our platform (Tiers 1-4 and credit score +680). If there was significant predictive value in credit score bands that is not already captured in the Upstart Risk Tier, you would expect to see a significant spread between rows within each column. What you see when you look at the bottom left of the table is that there is very little separation of payment impairment rates across rows within each column. Contrastingly, you see significant separation of payment impairment within credit score band rows across the columns.

This ability to separate risk translated into significantly lower payment impairment rates for our more conservative bank partners than they might've incurred using traditional underwriting. Across Upstart Risk Tiers 1-4, the peak impairment rate was 3.5% (with the peak rate for Tiers 1-2 at just 2.6%). The average for loans with credit scores above 680 was 5.3%. This meant that for our conservative bank partners, Upstart Risk Tier was 34% more effective at reducing risk of payment impairment than credit score bands alone. This is a great demonstration of Upstart's ability to

simultaneously identify “hidden prime” borrowers, and to separate and appropriately identify and price riskier applicants who may appear low risk based on traditional measures alone.

“For our conservative bank partners, **Upstart Risk Tier was 34% more effective** at reducing risk of payment impairment than credit score bands alone.”

Rate of Payment Impairment by Credit Score and Upstart Risk Tier[6]

Risk based on Upstart Risk Tier →

Risk based on credit score ↑

	Tiers 1-2	Tiers 3-4	Tiers 5-6	Tiers 7-8	Tiers 9-10	**Average**
Below 640	2.9%	4.0%	5.3%	6.3%	7.0%	**5.5%**
640 to 659	2.8%	4.7%	6.4%	7.9%	7.7%	**6.1%**
660 to 679	2.7%	4.9%	6.9%	7.5%	8.6%	**6.1%**
680 to 699	2.8%	4.7%	7.1%	9.3%	9.4%	**6.0%**
700 to 720	2.6%	4.6%	6.8%	9.1%	8.7%	**5.2%**
Above 720	2.5%	4.6%	7.2%	9.1%	9.4%	**4.6%**
Average	**2.6%**	**4.6%**	**6.7%**	**8.1%**	**8.4%**	

Typical bank risk appetite

Conclusion

This data shows that Upstart's AI-based risk models were effective tools for both reducing the risk of a default in a portfolio pre-crisis, and for limiting the rate of impairment of a portfolio during the current period of economic stress. While this data doesn't answer the question of whether Upstart's credit model (let alone AI models in general) will outperform more traditional models as we continue through the current economic stress or in future crises, we think it shows that they can. We believe that these results will embolden leadership within the credit industry to push forward into a new era of AI-enabled lending.

If you're interested in a deeper dive in the data presented, or would like to speak with our team about how you can leverage Upstart's credit decisioning and risk modeling to power growth in your consumer lending program, please email me at **jeffkeltner@upstart.com.**

1 According to an Upstart retrospective study completed in December 2019. The study defined access to prime credit as individuals with credit reports with VantageScores of 720 or above.
2 Payment impairment is based on a percentage of the total dollar amount of the portfolio.
3 Loans subject to the borrower hardship program were put into forbearance and not classified as delinquent through the duration of the hardship plan.
4 Note: As of December, 31st 2020 excluding weekends and holidays. Source: DV01 reports on Personal Loan originators. Payment impairment represents loans in active forbearance or with Days Past Due greater than or equal to 1.
5 Note: As of December 31st, 2020. Source: DV01 reports on Personal Loan originators Includes all loan modification granted between March 6, 2020 and December 31st, 2020.
6 Impairment rates in May 2020

Upstart